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Awakening India

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ABSTRACT

Clean India implies Smart India. A City will become a smart city when it has amicable human environment and high quality of life. To define ourself smart first of all stands clean, healthy and tidy appearance at last comes the wealth. The economy will come to action only when the responsibility realized by the citizens. This paper deals with a major problem of sewage and its treatment.

Keywords: clean, healthy, Ostara.

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1. INTRODUCTION

A smart city is one which enjoys sustainable economic growth and high standard of living with rapid growth. With rapid growth in population accompanied by urbanisation, the housing shortage in the country will only get more acute. India's population is expected to reach 1.3 billion by 2021. By 2022, more than one-third of the population will be city dwellers. As of 2011, 31 per cent of India's population lived in urban areas. Our bigger challenge is not the building of newer smart city. It is about making the existing cities smatter.

1.1. Challenges for India

Infra structure

Institutional infrastructure, physical infrastructure and social infrastructure constitute three pillars on which smart city rests. Institutional infrastructure refers to the activities that relate to the planning and management systems. Physical infrastructure refers to urban mobility system, the housing stock, the energy system, the water supply system, sewage system, sanitation facilities, solid waste management system and drainage system which are all integrated through the use of technology.

Social infrastructure helps in improving human capital index so lot of emphasis should be on education, healthcare and entertainment systems. Quality education for school and higher education, quality healthcare facilities and good entertainment facilities like sport facilities, cultural centers, open spaces and plazas are essential ingredients for quality life. These things exist as a challenge. In addition to that our country is over populated.

2. CURRENT STATUS

Seventy per cent of municipal sewage and effluents from over 900 cities and towns is being discharged untreated into rivers those are a major source of drinking water, according to a recent study by the Central Pollution Control Board. Indian cities and towns together are generating an estimated sewage load of 38,254 million litres per day (MLD) and are treating only 11,787 MLD, which shows a capacity gap of 26,467 MLD, says a new report by the Central Pollution Control Board (CPCB) on water consumption and sewage disposal patterns across the country.

2.1. Decaying Indian Cities

Delhi tops the list -- the national capital generates over 3,800 MLD of sewage per capita. Mumbai is the second big polluter with 2,671 MLD, and Kolkata third with 705 MLD. The study shows that only eight cities -- Hyderabad, Ahmedabad, Delhi, Mumbai, Pune, Ludhiana, Chennai and Vadodara -- treat more than half their sewage. The fourth report in a series based on data available in 2008, of 498 Class I cities (with over 1 lakh population) and 410 Class II towns, shows that the biggest cities in India are only treating 50% of the sewage they generate. Not only is the rest going into rivers -- the source of drinking water -- it is also polluting the sea.

Kolkata, Mumbai and Chennai account for 60% of sewage spewed into the sea. Cities like Kolkata, Patna, Kanpur, Dehra Dun and Allahabad dispose of huge amounts of waste directly into the river Ganga.

According to the report, of the total 38,254 MLD sewage, the greatest contribution of over 35,000 MLD comes from Class I cities while the remaining 2,696 MLD is from Class II towns.

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"This evidently indicates the ominous position of sewage treatment, which is the main source of pollution in rivers and lakes, and hence there is an urgent need for implementing an action plan to arrest the pollution of rivers,"

While the current state of sewage disposal poses a huge health problem, it is also a waste of resources. "Sewage water has nutrients like nitrogen and phosphorus. The nutrient value of this water is between Rs 75 per hectare per annum and Rs 400 per hectare per annum. The only way out is to set up systems wherein this water can be used for irrigation and fertilisation in fields and horticultural areas," said a senior scientist from the CPCB. India needs to replace conventional technologies with advanced technologies. At present, after being treated in different sewage treatment plants and common effluent treatment plants, the industrial wastewater goes into drains and eventually gets discharged into the river. Even farmers may be able to use it for irrigation. The recycled water can be sold to end users. It is really very strange that Delhi, which is India's national Capital, one of the fastest growing metropolitan cities of the country, does not have a proper sewage disposal and drainage system. Delhi is facing severe problem of untreated sewage such that only about 55% homes in Delhi are linked to a proper sewerage and the rest of the 45% of wastes goes in to the Yamuna river directly. In spite of the fact that a number of plans and programmes have been implemented by the Government for sewage and wastewater treatment, these are not being able to keep pace with the growing generation of waste water. While there are certain sections like developed and organized areas of Delhi which are given wastewater treatment services to a certain extent, the slums or the unorganized areas are not provided any sewage treatment, the reason being they are not within the jurisdiction of the Delhi Jal Board (DJB).

2.2. Facts of sewage treatment in Delhi

Also, the national Capital does not have a proper drainage system and sewer lines. There are 30 sewage treatment plants located at 17 locations in Delhi, out of which only two are running within the capacity limit, 20 are running under capacity, five are running over capacity and three are non-functional

2.3. Outcome of sewage problems

Improper and inadequate sewage treatment has impacted the environment and the citizens of Delhi in many ways:

- Malfunctioning septic systems have resulted in contamination of well water, ground water, river water and causing threats to public health
- Untreated sewage have led to stinking and foul smell
- Direct physical exposure to wastewater for people bathing and washing clothes and utensils
- Toxic food farming has increased around the Yamuna River due to improper sewage treatment, leading to various diseases like as vomiting, gastroenteritis, diarrhea, blood infection, dehydration, kidney dysfunction and urinary infection.
- The toxins have polluted the ground water and soil.
- Most of treatment plants do not perform effectively due to operational problems.
- The present capacity of the STPs is underutilized on account of deficiency in the collection system.
- The large network of sewers and drains in the city is very old and most of them are small and also in damaged condition.
- Low flow of sewage to STPs
- No proper sewage management and planning

2.4. Three Ways of Sewage Treatment

- Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment.
- Secondary treatment removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous, water-borne micro-organisms in a managed habitat. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.
- Tertiary treatment is sometimes defined as anything more than primary and secondary treatment in order to allow rejection into a highly sensitive or fragile ecosystem (estuaries, low-flow rivers, coral reefs. Treated water is sometimes disinfected chemically or physically (for example, by lagoons and microfiltration) prior to discharge into a stream, river, bay, lagoon or wetland, or it can be used for the irrigation of a golf course, green way or park. If it is sufficiently clean, it can also be used for groundwater recharge or agricultural purposes.

3. NO MORE WASTE WATER IS CONSIDERED AS WAST

- It may be tricky to see dollar signs or green qualities when you think about sewage, but Vancouver-based company Ostara has found a way to connect the three by pulling commercial value from waste water. Its technology harvests phosphorus and ammonia from municipal sewage treatment plants and turns it into fertilizer pellets. The process saves cities money by keeping sewage treatment plants humming efficiently, and it will likely reduce polluted runoff from agriculture because the fertilizer is easier for plants to absorb than standard fertilizer applications.
- Founded in 2005 after licensing its technology from the University of British Columbia at Vancouver, Ostara's customers thus far have been municipal sewage treatment plants in Canada, the US, and most recently, England. But it soon hopes to expand its business to industrial customers, including commodities-grade phosphorus rock processing plants.
- Phosphorus for agricultural fertilizer has typically been harvested from rock, with the greatest remaining reserves in Morocco and Western Sahara, China, and Algeria. The price of phosphorus has tripled since 2006 due to supply shortages. That value has created a key market opportunity for Ostara.
- "Waste water is no longer seen as waste," said Phillip Abrary, president and CEO of Ostara.
- The company is offering an important service to municipal treatment plants. State and federal regulations have grown increasingly stringent on the amount of phosphorus that can be in the water a plant returns to nature after processing. That's because, although phosphorus occurs naturally, when there is too much of it in water – from human or animal waste or from runoff from gardens, lawns, or agricultural – algae – can bloom, sucking oxygen out of the water and killing other aquatic life.
- Ostara partners with plants that meet their phosphorus discharge limits by using microorganisms to remove the element from the rest of the sewage, a process called bio-P. The microorganisms are then treated in a digester, which in turn creates a solid "sludge cake" that is given to farmers as a soil amendment or incinerated, biogas, and a liquid waste stream. The latter contains most of the phosphorus and is typically routed back through the treatment plant.
- Routing the phosphorus back to the head of the plant is a burden because it causes scale on the pipes and can reduce capacity to manage and process incoming phosphorus and ammonia.
- Ostara's technology, called the Pearl system, takes that liquid waste stream, known as "dewatering liquors", and pulls out more than 85% of the phosphorus and approximately 10-30% of the ammonia by adding magnesium to form a precipitation reaction. The end result is crystals composed of phosphorus, nitrogen, and magnesium that Ostara markets as Crystal Green fertilizer.
- The fertilizer it produces is a controlled, or slow-release type. Traditional fertilizers dissolve when water hits them, via rain or irrigation, and they disperse quickly, often before plants can absorb them.

3.1. Enhanced Efficiency Fertilizer

Crystal Green is the first slow-release nutrient technology to offer plant-available phosphorus, with nitrogen and magnesium, in one citrate-soluble granule.

Made by Ostara Nutrient Recovery Technologies, Ostara's proprietary Pearl® technology sustainably transforms phosphorus and nitrogen recovered from nutrient-rich water streams, plus magnesium, into a high-value, eco-friendly fertilizer that enhances nutrient efficiency, while significantly reducing the risk of leaching and runoff.

- Season-long nutrient release of 160-200 days

- Promotes healthy root development
- Phosphorus and magnesium work together for more vibrant growth
- Significantly reduces risk of leaching and runoff
- Minimizes nutrient loss
- Suitable for turf, nursery, agriculture and specialty agriculture
- Tested at leading universities and in field trials
- 99.9% pure, dust free compound
- Uncoated, slow-release nitrogen, phosphorus and magnesium
- Plant roots release organic acid when they want to feed, and Crystal Green releases phosphorus, nitrogen, and magnesium in response to that signal, he said. Plants can better absorb this type of fertilizer, reducing the amount that runs off the land and into nearby water bodies.
- Ostara's Pearl system helped maintain operational stability; save money on the reduced need for amendments to manage the phosphorus, such as alum and lime; and reduce the tonnage of dry tons of sludge, which reduces handling costs, according to a 2013 paper published in Water Science & Technology.

3.2. The common problem of struvite

Also known as magnesium ammonium phosphate, Struvite can develop quickly and its crystals can grow like weeds until it all but shrinks the flow area in a pipeline to nothing. It is A common occurrence in wastewater treatment plants and can quickly get out of control. When the conditions are right it will rapidly form crystals that spread throughout a pipeline forming a concrete-like crust. It is most commonly a problem in dewatering filtrate or lagoon decant and in spots with local turbulence, such as pipe elbows, mixer blades and pumps.

Struvite can become debilitating if left unchecked. Like cholesterol coating the walls of vessels and arteries, Struvite can reduce flow area significantly, severely restricting flow and reducing pressure. Struvite can damage equipment, especially valves, when the valves close it rips the rubber faces of the plugs stopping the ability to shut valves tightly.

- Phosphorus can build up on pipes and equipment, forming a concrete like scale called struvite. Removing it, either manually or with chemicals, is time-consuming and expensive.
- Avoiding those costs is part of what makes the Pearl system economically attractive.
- Ostara has done pilot projects and commercial demonstrations at phosphate fertilizer plants in Florida and is talking to other processors in China and South America. It has also done pilot studies on animal waste.
- It has not yet made an industrial deal, and business models are still under discussion. The first full-scale nutrient recovery installation in North America became operational in May 2009 at the Clean Water Service's Durham Advanced Wastewater Treatment Plant in Tigard, Oregon. Recovering ammonia and phosphorus from the dewatering side stream as struvite has a positive impact on plant operations. Significantly reducing the phosphorus recycle lowers the phosphorus loading on the plant, stabilizes biological phosphorus removal, reduces the amount of chemicals needed to remove phosphorus, reduces both the dry tonnes of biosolids generated and the phosphorus content of the biosolids, and provides revenue from the sale of the struvite. To increase struvite production and to decrease struvite potential in the digestion system, the Waste Activated Sludge Stripping

To Remove Internal Phosphorus (WASSTRIP™) process was implemented full-scale in summer 2011. Results indicate a potential 60% increase in struvite production is achievable.

- Clean Water Services was Ostara's first US customer. It operates four waste water treatment plants in the Tualatin River watershed in Washington County, Oregon. It added the Pearl system to its Durham plant in 2009 and later installed the Pearl system at its Rock Creek facility. "It seemed like a smart thing to do environmentally and from a business perspective.
- Although utilities were cleaning phosphorus out of water prior to partnering with Ostara – the Canadian company just helped them to operate their facilities more efficiently – there is a way the Pearl system reduces water pollution more directly.
- Municipal sewage treatment centers are a natural customer for Ostara, and it has new clients in Madison, Wisconsin; Chicago, Illinois; and Gwinnett County,Georgia.
- But the company is also looking to branch out into the industrial market. Facilities that process mined phosphate rock into fertilizer also generate a lot of phosphorus-rich liquid waste. Ostara has developed a new process to harvest phosphorus from that water, which the fertilizer company can then reuse in its facility or discharge it into the environment.
- Ostara reactors harvest phosphorus from raw sewage

4. THE PROCESS

Ostara's PEARL Nutrient Recycling Process, developed at Vancouver's University of British Columbia, utilizes something called a proprietary fluidized bed reactor. The cone-shaped device is installed in a wastewater treatment plant, where it removes ammonia and most of the phosphorus from untreated sewage. Magnesium is added within the reactor, creating a concrete-like substance known as struvite. This struvite, in turn, is processed into a nitrogen/phosphorus/magnesium slow-release fertilizer sold as Crystal Green. Ostara claims that numerous trials have proven the fertilizer to be safe, and because of its slow-release properties, it stays in the soil instead of running off into waterways.

5. CLEANING WATER

The removal of so much phosphorus, needless to say, makes the wastewater that much cleaner when it finally returns to the natural environment. Hopefully, Ostara's system should decrease the occurrence of toxic blue-green algae blooms, which can occur when wastewater containing too many nutrients enters a body of water such as a river. While wastewater treatment plants already remove much of the phosphorus and other nutrients, the installation of a reactor would greatly reduce the bioload on the plant.

6. PHOSPHORUS IN AGRICULTURE

Functions of Phosphorus in Plants

In the plant, phosphorus is essential for a number of physiological functions that are involved with energy transformations. Phosphorus is a component of many cell constituents and plays a major role in several key processes, including photosynthesis, respiration, energy storage and transfer, cell division, and cell enlargement. Adequate phosphorus is needed for the promotion of early root formation and growth. Phosphorus also improves crop quality and is necessary for seed formation. Functions of Phosphorus in Animals Livestock also require phosphorus for proper growth. In addition to other functions, phosphorus is an essential component of bones and teeth. Animals derive their phosphorus needs from plant products and feed supplements.

Phosphorus and Livestock Operations The buildup of soil phosphorus to excessive levels can occur when any phosphorus source, including commercial fertilizer, biosolids and manure, is over applied.

Phosphorus Losses & Removal from Agricultural Systems Phosphorus is removed or lost from the soil by: 1) crop uptake & removal; 2) runoff & erosion; and 3) leaching Harvested crops remove phosphorus from the soil and the farm. Phosphorus concentrations in plant tissues typically range from 0.1 to 0.5% on a dry weight basis and most crops utilize or take up between 20 and 90 pounds of P2O5 each year . Since soils are natural systems that are constantly subjected to changes due to the combined effects of the environment and management practices, it is impossible to totally eliminate phosphorus losses from soil. Water moving across the surface or through soils can remove both soluble and particulate forms of soil phosphorus .The transport of particulate and soluble phosphorus can increase the concentration of bioavailable phosphorus in surface waters Bioavailable phosphorus is the portion of phosphorus which can be used . Processes that are responsible for the transport of phosphorus from agricultural fields to surface water. In most soils, potential losses of phosphorus in surface runoff are much greater as compared to losses by leaching and subsurface flow.

Phosphorus enrichment of surface water involves a combination of high soil phosphorus and conditions that favor the transport of phosphorus to surface waters. Thus, reducing soil phosphorus accumulation, runoff, and erosion will decrease the potential for transport of bioavailable phosphorus. Producers should focus on managing both the source of phosphorus and the potential transport of phosphorus out of a field.

Controlling soil erosion is the critical step in keeping phosphorus in agricultural fields. Soils with high loadings of phosphorus will deliver high loadings of phosphorus to surface streams if sediments are washed into streams. If erosion is controlled, then the potential for losses of dissolved phosphorus in surface runoff becomes the primary concern. Conservation practices that can be used to reduce erosion and surface runoff include strip cropping, conservation tillage, winter cover crops, etc. Filter strips, buffer zones and riparian areas can be effective at trapping sediment phosphorus at field boundaries, but they are not very effective at trapping dissolved phosphorus

6.1. Importance of Phosphorus to Plants

Phosphorus is a component of the complex nucleic acid structure of plants, which regulates protein synthesis. Phosphorus is, therefore, important in cell division and development of new tissue. Phosphorus is also associated with complex energy transformations in the plant.

6.2. In the Nut Shell

In my point of view when we meet the challenge of sewage it directly paves a way for transport and mobility and also build a healthy nation.

Informed and inter connected is the manifesto for smart cities. “Most of the things you need for a smart city already exist”. Using this opportunity I kindly request our honourable PM to take initiative to incorporate this technology with foreign collaboration to clean India movement which will automatically make India 80% smarter. “The Only way of finding the limit of the possible is by going beyond then into the impossible”.

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